(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 434 427 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : 90314020.0

(22) Date of filing : 20.12.90

(51) Int. Cl.^{5} : **H04N 7/13**

(30) Priority : 20.12.89 JP 330622/89

(43) Date of publication of application :
26.06.91 Bulletin 91/26

(84) Designated Contracting States :
DE GB SE

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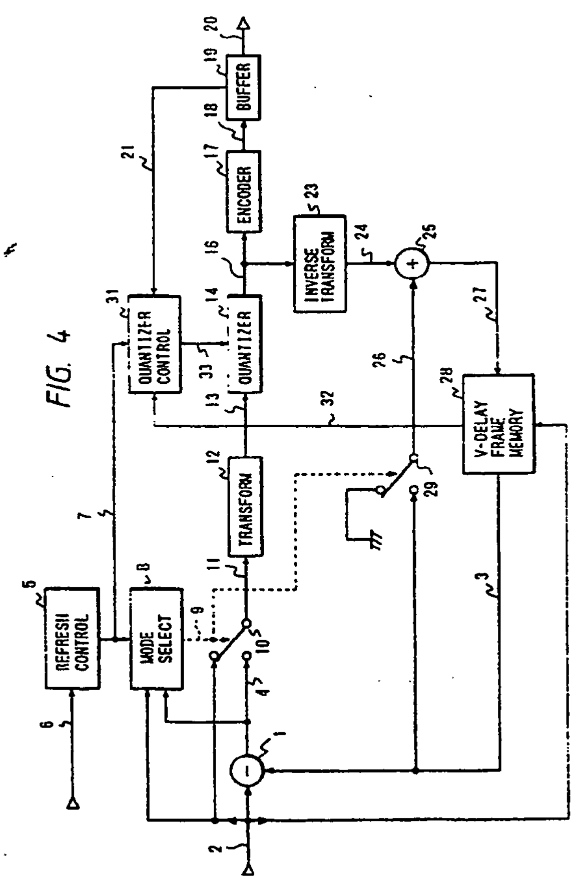
(54) Moving-image signal encoding apparatus.

(57) A moving-image signal encoding apparatus includes a transmission buffer memory. A first quantization step size for a normal block other than a refreshed block is determined on the basis of an occupied capacity of the buffer memory. A second quantization step size for the refreshed block is determined on the basis of the first quantization step size. A refreshment instruction signal is generated. One of the first quantization step size and the second quantization step size is selected in response to the refreshment instruction signal.

FIG. 4



EP 0 434 427 A2

MOVING-IMAGE SIGNAL ENCODING APPARATUS

This invention relates to an apparatus for encoding a signal representing moving images or pictures which is usable in various systems such as a video-telephone system or a conference television system.

Some video-telephone systems and conference television systems have an apparatus for encoding a moving-image signal. In general, such a moving-image signal encoding apparatus executes digital signal processing for compressing image data by use of image-data correlation, for compressing the image data by quantization, and for encoding the image data into codes of a predetermined format. As will be explained later, a prior art moving-image signal encoding apparatus has a problem.

As shown in Fig. 1, a prior art moving-image signal encoding apparatus includes a subtracter 1 which receives a digital input image signal 2 and a digital inter-frame prediction signal 3 and outputs a prediction error signal 4 equal to the difference between the signals 2 and 3.

A refresh controller 5 receives a timing signal 6 and outputs a refresh instruction signal 7 in response thereto. A data-processing mode selector 8 receives the input image signal 2, the prediction error signal 4, and the refreshment instruction signal 7, and outputs a change control signal 9 dependent upon the signals 2, 4, and 7. As will be made clear later, the data-processing mode selector 8 selects between inter-frame data processing and intra-frame data processing. A switch 10 receives the input image signal 2, the prediction error signal 4, and the change control signal 9. The switch 10 is connected to the input terminal of an orthogonal transform device 12. The switch 10 selects one of the input image signal 2 and the prediction error signal 4, and transmits the selected signal to the orthogonal transform device 12 as a signal 11 to be subjected to orthogonal transform.

The signal 11 selected by the switch 10 is subjected to predetermined orthogonal transform by the orthogonal transform device 12 so that transform coefficients are generated on the basis of the signal 11. Data 13 representing the transform coefficients are outputted from the orthogonal transform device 12.

A quantizer 14 receives the transform coefficient data 13 and also data 15 representing a quantization step size. The quantizer 14 quantizes the transform coefficient data 13 with the quantization step size represented by the data 14, and converts the transform coefficient data 13 into data 16 representing second transform coefficients. An encoder 17 receives the second transform coefficient data 16 and encodes the data 16 into coded data 18 of a predetermined format. The coded data 18 are output from the encoder 17. A transmission buffer 19 including a memory receives the coded data 18 and temporarily stores it. The coded data 18 is then output from the transmission buffer 19 as a transmission signal 20. The transmission buffer 19 generates a signal 21 representing the amount of coded data remaining in the internal memory, that is, representing the size of an area of the internal memory which is occupied by the coded data. A quantizer controller 22 receives the signal 21 and generates the quantization step size data 15 on the basis of the signal 21. The quantization step size data 15 are output from the quantizer controller 22 to the quantizer 14. As a result, the quantization step size used by the quantizer 14 is controlled in response to the amount of coded data in the buffer.

An inverse orthogonal transform device 23 receives the second transform coefficient data 16. The second transform coefficient data 16 are subjected by the inverse orthogonal transform device 23 to a predetermined inverse orthogonal transform, and are converted back to a reproduction signal 24. The reproduction signal 24 is output from the inverse orthogonal transform device 23. An adder 25 receives the reproduction signal 24. A switch 29 receives the inter-frame prediction signal 3, the change control signal 9, and a zero signal representing "0". The switch 29 selects one of the inter-frame prediction signal 3 and the zero signal in response to the change control signal 9, and outputs a signal 26 equal to the selected signal. The adder 25 receives the output signal 26 from the switch 29. The adder 25 adds the reproduction signal 24 and the switch output signal 26, and combines the signals 24 and 26 into a decoded signal 27. A section 28 including a variable-delay circuit and a frame memory receives the decoded signal 27 and the input image signal 2. The variable-delay frame memory 28 temporarily stores the decoded signal 27, and generates the inter-frame prediction signal 3 on the basis of the stored decoded signal 27 and the input image signal 2. The inter-frame prediction signal 3 is output from the variable-delay frame memory 28. As will be made clear later, the inter-frame prediction signal 3 is a motion-compensated signal.

A refresh process is executed for compensating for differences in accuracy between the encoder at the transmitter and the decoder at the receiver, and also for compensating for errors in the coded data wich occur during transmission of it. One frame, represented by the signals 11 and 27, is separated into blocks each having M pixels by N lines, where M and N denote predetermined natural numbers. The refresh process includes a scanning process such that blocks are sequentially and periodically selected for refreshing. The block to be refreshed is changed cyclically so that all the blocks will be refreshed during a given time. A decision is made as to whether or not

refreshment is to be done for each of the blocks. The refreshment controller 5 sends a refreshment instruction signal 7 to the data-processing mode selector 8 for each block which is to be refreshed. The ratio of the number of refreshed blocks in a frame to the total number of blocks in each frame is equal to a predetermined ratio chosen such that all the blocks will be refreshed in about 10 seconds. The period in which all the blocks are refreshed is referred to as the refreshment period.

When the refreshment instruction signal 7 is active, the data-processing mode selector 8 selects of intra-frame data processing. When the refreshment instruction signal 7 is inactive, the data-processing mode selector 8 selects either inter-frame data processing or intra-frame data processing depending on the input image signal 2 and the prediction error signal 4. When intra-frame data processing is selected, the switch 10 is controlled by the change control signal 9 so that the input image signal 2 is selected by the switch 10, to enable the intra-frame data processing. When inter-frame data processing is selected, the switch 10 is controlled by the change control signal 9 so that the prediction error signal 4 is selected by the switch 10, to enable the inter-frame data processing.

The quantizer 14 is of the linear type. As described previously, the transform coefficients 13 output from the orthogonal transform device 12 are quantized by the quantizer 14 with the quantization step size represented by the data 15, so that the transform coefficients 13 are converted by the quantizer 14 into the second transform coefficients 16. The quantizer controller 22 varies the quantization step size in accordance with the buffer remaining-code-amount represented by the signal 21. The quantizer 14 and the encoder 17 are related so that the number of bits of the coded data 18 output from the encoder 17 will depend on the quantization step size used by the quantizer 14. The quantizer 14, the encoder 17, the transmission buffer 19, and the quantizer controller 22 form a closed-loop control circuit which serves to maintain the quantity (the amount or the number of bits) of coded data in the transmission buffer 19 at or below a desired quantity.

As described previously, the signal selected by the switch 29 changes in response to the change control signal 9. When inter-frame data processing is selected by the data-processing mode selector 8, the switch 29 is controlled by the change control signal 9 so that the inter-frame prediction signal 3 is selected by the switch 29 to enable inter-frame data processing. When intra-frame data processing is selected by the data-processing mode selector 8, the switch 29 is controlled by the change control signal 9 so that the zero signal is selected by the switch 29 to enable the intra-frame data processing. The output signal 26 from the switch 29 and the output reproduction signal 24 from the inverse transform device 23 are combined into the decoded signal 27 by the adder 25. The decoded signal 27 is stored into a store section of the variable-delay frame memory 28. The variable-delay frame memory 28 has a motion detector which compares the stored decoded signal 27 and the input image signal 2, and which detects a motion vector on the basis of the result of the comparison between the signals 27 and 2. The detected motion vector represents a motion of the image represented by the input image signal 2. The variable-delay frame memory 28 has a motion compensator which subjects the stored decoded signal 27 to motion compensation in response to the motion vector, and thereby converts the stored decoded signal 27 into the motion-compensated inter-frame prediction signal 3.

As shown in Fig. 2, the quantizer controller 22 includes a ROM 30 storing data representing different quantization step sizes. The signal 21 is fed to the ROM 30 as an address signal, and the ROM 30 outputs data 15 of a quantization step size which varies as a function of the amount of coded data in the buffer as represented by the signal 21. As shown in Fig. 3, the quantization step size represented by the data 15 is approximately proportional to the amount of coded data in the buffer in a stepwise manner.

In the prior art moving-image encoding apparatus of Fig. 1, the quantization step size used by the quantizer 14 is independent of whether or not the block quantized by the quantizer 14 is being refreshed, so that a refreshed block tends to be low in image quality.

It is an aim of this invention to provide an improved moving-image signal encoding apparatus.

According to the first aspect of the present invention, there is provided a moving-image signal encoding apparatus comprising :

a transmission buffer memory ;

means for determining a first quantization step size for a normal block other than a refreshed block on the basis of the occupied capacity of the buffer memory ;

means for determining a second quantization step size for the refreshed blocks on the basis of the first quantization step size ;

means for generating a refresh instruction signal ; and

means for selecting either of the first quantization step size or the second quantization step size according to the refresh instruction signal.

According to a second aspect of the present invention, there is provided a moving-image signal encoding apparatus comprising :

a transmission buffer memory ;

means for determining a first quantization step size for a normal block other than a refreshed block on the basis of the occupied capacity of the buffer memory ;

means for determining a second quantization step size for the refreshed blocks in a moving reg-

ion of the image on the basis of the first quantization step size ;

means for determining a third quantization step size for the refreshed blocks in a stationary region of the image on the basis of the first quantization step size ;

means for generating a refresh instruction signal;

means for generating a moving/stationary information signal ; and

means for selecting one of the first quantization step size, the second quantization step size, and the third quantization step size in response to the refresh instruction signal and the moving/stationary information signal.

According to a third aspect of the present invention, there is provided a moving-image signal encoding apparatus comprising :

means for refreshing a portion of image data ;

means for quantizing information in the image data with a variable quantization step size ; and

means for varying the quantization step size in the quantizing means in response to whether or not the information quantized by the quantizing means corresponds to the refreshed portion of the image data.

The present invention will be further explained with reference to the following description of an exemplary embodiment and the accompanying drawings, in which :

Fig. 1 is a block diagram of a prior art moving-image signal encoding apparatus.

Fig. 2 is a block diagram of the quantizer controller of Fig. 1.

Fig. 3 is a diagram showing the relation between a quantization step size and a buffer remaining-code-amount in the apparatus of Fig. 1.

Fig. 4 is a block diagram of a moving-image signal encoding apparatus according to an embodiment of this invention.

Fig. 5 is a block diagram of the quantizer controller of Fig. 4.

Figs. 6-8 are diagrams showing relations between a refreshed-block quantization step size and a nonrefreshed-block quantization step size in the apparatus of Fig. 4.

Fig. 9 is a block diagram of a portion of the variable-delay frame memory of Fig. 4.

As shown in Fig. 4, a moving-image signal encoding apparatus according to an embodiment of this invention includes a subtracter 1 which receives an input digital image signal 2 and an inter-frame prediction signal 3 and outputs a prediction error signal 4 equal to the difference between the signals 2 and 3.

A refresh controller 5 receives a timing signal 6 and outputs a refresh instruction signal 7 in response to the timing signal 6. A data-processing mode selector 8 receives the input image signal 2, the prediction error signal 4, and the refresh instruction signal 7, and outputs a change control signal 9 dependent on the signals 2, 4 and 7. As will be made clear later, the data-processing mode selector 8 selects between inter-frame data processing and intra-frame data processing. A switch 10 receives the input image signal 2, the prediction error signal 4, and the change control signal 9. The switch 10 is connected to the input terminal of an orthogonal transform device 12.

The switch 10 selects one of the input image signal 2 and the prediction error signal 4, and transmits the selected signal to the orthogonal transform device 12 as a signal 11 to be subjected to orthogonal transform.

The signal 11 selected by the switch 10 is subjected to a predetermined orthogonal transformation by the orthogonal transform device 12 so that transform coefficients are generated on the basis of the signal 11. Data 13 representing the transform coefficients are output from the orthogonal transform device 12.

A quantizer 14 receives the transform coefficient data 13 and also data 33 representing a quantization step size. The quantizer 14 quantizes the transform coefficient data 13 with the quantization step size represented by the data 33, and converts the transform coefficient data 13 into data 16 representing second transform coefficients. An encoder 17 receives the second transform coefficient data 16 and encodes the data 16 into coded data 18 of a predetermined format. The coded data 18 are output from the encoder 17. A transmission buffer 19 including a memory receives the coded data 18 and temporarily stores it. The coded data 18 are then output from the transmission buffer 19 as a transmission signal 20. The transmission buffer 19 generates a signal 21 representing the amount of coded data remaining in the internal memory, that is, representing the size of an area of the internal memory which is occupied by the coded data. A quantizer controller 31 receives the refreshment instruction signal 7, the signal 21, and a signal 32 representative of moving/stationary information, and generates the quantization step size data 33 on the basis of the signals 7, 21, and 32. The quantization step size data 33 are output from the quantizer controller 31 to the quantizer 14. As a result, the quantization step size used by the quantizer 14 is controlled in response to the refreshment instruction signal 7, the signal 21, and the moving/stationary information signal 32.

An inverse orthogonal transform device 23 receives the second transform coefficient data 16. The second transform coefficient data 16 are subjected by the inverse orthogonal transform device 23 to a predetermined inverse orthogonal transformation, and are converted back to a reproduction signal 24. The reproduction signal 24 is output from the inverse orthogonal transform device 23. An adder 25 receives the reproduction signal 24. A switch 29 receives the inter-frame prediction signal 3, the change control sig-

nal 9, and a zero signal representing "0". The switch 29 selects one of the inter-frame prediction signal 3 and the zero signal in response to the change control signal 9, and outputs a signal 26 equal to the selected signal. The adder 25 receives the output signal 26 from the switch 29. The adder 25 adds the reproduction signal 24 and the switch output signal 26, and combines the signals 24 and 26 into a decoded signal 27. A section 28 including a variable-delay circuit and a frame memory receives the decoded signal 27 and the input image signal 2. The variable-delay frame memory 28 temporarily stores the decoded signal 27, and generates the inter-frame prediction signal 3 and the moving/stationary information signal 32 on the basis of the stored decoded signal 27 and the input image signal 2. The inter-frame prediction signal 3 and the moving/stationary information signal 32 are output from the variable-delay frame memory 28. As will be made clear later, the inter-frame prediction signal 3 is a motion-compensated signal.

The moving-image signal encoding apparatus of Fig 4 will be further described. A refresh process is executed for compensating for differences in accuracy between the encoder of the transmitter and the decoder of the receiver side, and also for compensating for errors in coded data which occur during the transmission of the data. One frame represented by the signals 11 and 27 is separated into blocks each having M pixels by N lines, where M and N denote predetermined natural numbers. The refresh process includes a scanning process such that blocks are sequentially and periodically selected for refreshing. The block to be refreshed is changed cyclically so that all the blocks will be refreshed during a given time. A decision is made as to whether or not each block is to be refreshed. The refreshment controller 5 sends a refreshment instruction signal 7 in an active state to the data-processing mode selector 8 for each block which is to be refreshed. The ratio of the number of refreshed blocks in a frame to the total number of blocks in a frame is equal to a predetermined ratio chosen such that all the blocks will be refreshed in about 10 seconds. The period taken to refresh all the blocks is referred to as the refreshment period.

When the refreshment instruction signal 7 is active, the data-processing mode selector 8 selects intra-frame data processing. When the refreshment instruction signal 7 is inactive, the data-processing mode selector 8 selects either inter-frame data processing or intra-frame data processing according to the input image signal 2 and the prediction error signal 4. When intra-frame data processing is selected, the switch 10 is controlled by the change control signal 9 so that the input image signal 2 will be selected by the switch 9 to enable the intra-frame data processing. When inter-frame data processing is selected, the switch 10 is controlled by the change control signal 9 so that the prediction error signal 4 will be selected by the switch 9 to enable the inter-frame data processing.

The quantizer 14 is of the linear type. As described previously, the transform coefficients 13 output from the orthogonal transform device 12 are quantized by the quantizer 14 with the quantization step size represented by the data 33, so that the transform coefficients 13 are converted by the quantizer 14 into the second transform coefficients 16. The quantizer controller 31 varies the quantization step size in accordance with the amount of data remaining in the buffer, as represented by the signal 21. The quantizer 14 and the encoder 31 are related so that the number of bits of the output codes 18 from the encoder 17 will depend on the quantization step size used by the quantizer 14. The quantizer 14, the encoder 17, the transmission buffer 19, and the quantizer controller 31 form a closed-loop control circuit which serves to maintain the quantity (the amount or the number of bits) of coded data in the transmission buffer 19 at or below a desired quantity.

As described previously, the signal selection by the switch 29 is changed in response to the change control signal 9. When inter-frame data processing is selected by the data-processing mode selector 8, the switch 29 is controlled by the change control signal 9 so that the inter-frame prediction signal 3 will be selected by the switch 29 to enable the inter-frame data processing. When intra-frame data processing is selected by the data-processing mode selector 8, the switch 29 is controlled by the change control signal 9 so that the zero signal will be selected by the switch 29 to enable the intra-frame data processing. The output signal 26 from the switch 29 and the output reproduction signal 24 from the inverse transform device 23 are combined into the decoded signal 27 by the adder 25. The decoded signal 27 is stored into a store section of the variable-delay frame memory 28. The variable-delay frame memory 28 has a motion detector which compares the stored decoded signal 27 and the input image signal 2, and which detects a motion vector on the basis of the result of the comparison between the signals 27 and 2. The detected motion vector represents a motion of the image represented by the input image signal 2. The variable-delay frame memory 28 has a motion compensator which subjects the stored decoded signal 27 to motion compensation in response to the motion vector, and thereby converts the stored decoded signal 27 into the motion-compensated inter-frame prediction signal 3. The detected motion vector is directly or indirectly used as the moving/stationary information signal 32.

As described previously, the quantizer controller 31 controls the quantization step size data 33 in response to the refreshment signal 7, the signal 21, and the moving/stationary information signal 32. The quantizer controller 31 will be further described hereinafter.

As shown in Fig. 5, the quantizer controller 31 includes a ROM 34 storing data representing first different quantization step sizes arranged and designed for nonrefreshed blocks. The signal 21 is fed to the ROM 34 as an address signal, and the ROM 34 outputs data 35 of a first quantization step size which varies as a function of the amount of data remaining in the buffer as represented by the signal 21. The first quantization step size data 35 are fed to a selector 42 as nonrefreshed-block quantization step size data.

The quantizer controller 31 also includes ROMs 36 and 38. The ROM 36 stores data representing second different quantization step sizes arranged and designed for refreshed moving-region blocks. Characteristics of the second quantization step sizes in the ROM 36 differ from characteristics of the first quantization step sizes in the ROM 34. The first quantization step size data 35 are fed to the ROM 36 as an address signal, and the ROM 36 outputs data 37 of a second quantization step size which varies as a function of the first quantization step size represented by the data 35. The ROM 38 stores data representing third different quantization step sizes arranged and designed for refreshed stationary-region blocks. Characteristics of the third quantization step sizes in the ROM 38 differ from characteristics of the first quantization step sizes in the ROM 34, and also differ from characteristics of the second quantization step sizes in the ROM 36. The first quantization step size data 35 are fed to the ROM 38 as an address signal, and the ROM 38 outputs data 39 of a third quantization step size which varies as a function of the first quantization step size represented by the data 35. The second quantization step size data 37 and the third quantization step size data 39 are fed to a selector 40. The selector 40 receives the moving/stationary information signal 32. The moving/stationary information signal 32 represents whether the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is in a moving part of the image or a stationary part of the image. The selector 40 selects one of the second quantization step size data 37 and the third quantization step size data 39 in response to the moving/stationary information signal 32, and outputs the selected data as refreshed-block quantization step size data 41. Specifically, when the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is from a moving image-part, the second quantization step size data 37 are selected by the selector 40. When the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is from a stationary image-part, the third quantization step size data 39 are selected by the selector 40. The refreshed-block quantization step size data 41 are fed to the selector 42.

The selector 42 receives the refreshment instruction signal 7. The refreshment instruction signal 7 represents whether the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is refreshed or not. The selector 42 selects either the nonrefreshed-block quantization step size data 35 or the refreshed-block quantization step size data 41 in response to the refreshment instruction signal 7, and outputs the selected data as the quantization step size data 33. Specifically, when the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is a nonrefreshed block, the nonrefreshed-block quantization step size data 35 are selected by the selector 42. When the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is a refreshed block, the refreshed-block quantization step size data 41 are selected by the selector 42.

As understood from the previous description, in the case where the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is a nonrefreshed block, the first quantization step size designed for a nonrefreshed block and output from the ROM 34 is used by the quantizer 14. In the case where the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is a refreshed moving-region block, the second quantization step size designed for a refreshed moving-region block and output from the ROM 36 is used by the quantizer 14. In the case where the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is a refreshed stationary-region block, the third quantization step size designed for a refreshed stationary-region block and output from the ROM 38 is used by the quantizer 14. Thus, the quantization step size used by the quantizer 14 is changed in response to whether the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 agrees with a refreshed block or a nonrefreshed block. Therefore, refreshed blocks can be prevented from deteriorating in image quality.

A further description will be given of the relation between the nonrefreshed-block quantization step size and the refreshed-block quantization step size represented by the data 35 and 41 respectively which occur at the same time. The characters θn and θr are now introduced to indicate the nonrefreshed-block quantization step size and the refreshed-block quantization step size respectively. As shown in the left-hand part of Fig. 6, in the case where the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 agrees with a stationary-region block, the refreshed-block quantization step size θr is smaller than the nonrefreshed-block quantization step size θn as is determined by a downwardly-facing convex function "f". As shown in the right-hand part of Fig. 6, in the case where the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 agrees with a moving-region block, the refreshed-block quantization step

size θr is smaller than the nonrefreshed-block quantization step size θn as is determined by a downwardly-facing convex function "g". The values of the function "g" are greater than the corresponding values of the function "f".

It should be noted that the relation between the nonrefreshed-block quantization step size θn and the refreshed-block quantization step size θr may be modified as follows. According to a first modification, as shown in the left-hand part of Fig. 7, in the case where the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 is a stationary-region block, the refreshed-block quantization step size θr is fixed at a predetermined minimum value θmin while the nonrefreshed-block quantization step size θn varies. According to the first modification, as shown in the right-hand part of Fig. 7, in the case where the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 agrees with a moving-region block, the refreshed-block quantization step size θr is fixed at a predetermined value θmov while the nonrefreshed-block quantization step size θn varies. The predetermined value θmov is greater than the minimum value θmin.

According to a second modification, as shown in the left-hand part of Fig. 8, in the case where the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 agrees with a stationary-region block, the refreshed-block quantization step size θr is equal to the greater of the minimum value θmin and the product of a predetermined positive constant "a" and the nonrefreshed-block quantization step size θn. The constant "a" is smaller than 1. According to the second modification, as shown in the right-hand part of Fig 8, in the case where the block corresponding to the transform coefficient data 13 quantized by the quantizer 14 agrees with a moving-region block, the refreshed-block quantization step size θr is equal to the greater of the minimum value θmin and the product of a predetermined positive constant "b" and the nonrefreshed-block quantization step size θn. The constant "b" is greater than the constant "a" but smaller than 1.

The generation of the moving/stationary information signal 32 will be described hereinafter. As shown in Fig. 9, the variable-delay frame memory 28 includes a motion detector 80 generating data 81 representative of a motion vector for each of blocks composing a frame. The motion vector data 81 are output from the motion detector 80 to a comparator 82 within the variable-delay frame memory 28. The motion vector is expressed by a two-dimensional notation having horizontal and vertical components X and Y, and is denoted as (X,Y). Data 83 representing a predetermined vector (0,0), that is, a stationary-state-indicating vector, is fed to the comparator 82. The comparator 82 compares the motion vector data 81 and the stationary-state vector data 83. When the motion vector data 81 differ from the stationary-state vector data 83, that is, when at least one of the components X and Y of the motion vector differs from "0", the comparator 82 outputs a "1" signal as the moving/stationary information signal 32. When the motion vector data 81 are equal to the stationary-state vector data 83, that is, when both the components X and Y of the motion vector are equal to "0", the comparator 82 outputs a "0" signal as the moving/stationary information signal 32.

Claims

1. A moving-image signal encoding apparatus comprising :
   - a transmission buffer memory ;
   - means for determining a first quantization step size for a normal block other than a refreshed block on the basis of the occupied capacity of the buffer memory ;
   - means for determining a second quantization step size for the refreshed blocks on the basis of the first quantization step size ;
   - means for generating a refresh instruction signal ; and
   - means for selecting either of the first quantization step size or the second quantization step size according to the refresh instruction signal.

2. A moving-image signal encoding apparatus comprising :
   - a transmission buffer memory ;
   - means for determining a first quantization step size for a normal block other than a refreshed block on the basis of the occupied capacity of the buffer memory ;
   - means for determining a second quantization step size for the refreshed blocks in a moving region of the image on the basis of the first quantization step size ;
   - means for determining a third quantization step size for the refreshed blocks in a stationary region of the image on the basis of the first quantization step size ;
   - means for generating a refresh instruction signal ;
   - means for generating a moving/stationary information signal ; and
   - means for selecting one of the first quantization step size, the second quantization step size, and the third quantization step size in response to the refresh instruction signal and the moving/stationary information signal.

3. A moving-image signal encoding apparatus comprising :

means for refreshing a portion of image data; means for quantizing information in the image data with a variable quantization step size ; and means for varying the quantization step size in the quantizing means in response to whether or not the information quantized by the quantizing means corresponds to the refreshed portion of the image data.

4. An apparatus according to claim 3 further comprising means for, in cases where the information quantized by the quantizing means corresponds to the refreshed portion of the image data, varying the quantization step size in the quantizing means in response to whether the information quantized by the quantizing means relates to a moving image region or a stationary image region.

5. The moving-image signal.encoding apparatus of claim 3 further comprising means for encoding an output from the quantizing means, means for temporarily storing an output from the encoding means, and means for varying the quantization step size in the quantizing means in response to the size of the occupied area of the storing means.

6. An apparatus for encoding a signal representative of a moving image and divided into blocks, the apparatus comprising :

refresh means for refreshing some of the blocks of the signal ;

quantization means for quantizing said signal using a quantization step size to generate a quantized output signal ;

buffer means for temporarily storing the quantized output signal ;

first quantizer control means for generating a first quantization step size for nonrefreshed blocks on the basis of the amount of data stored by said buffer means ; and

second quantizer control means for generating a second quantization step for refreshed blocks on the basis of said first quantization step ; wherein

said quantization means is adapted to quantize blocks that have been refreshed using said second quantization step and to quantize blocks that have not been refreshed using said first quantization step.

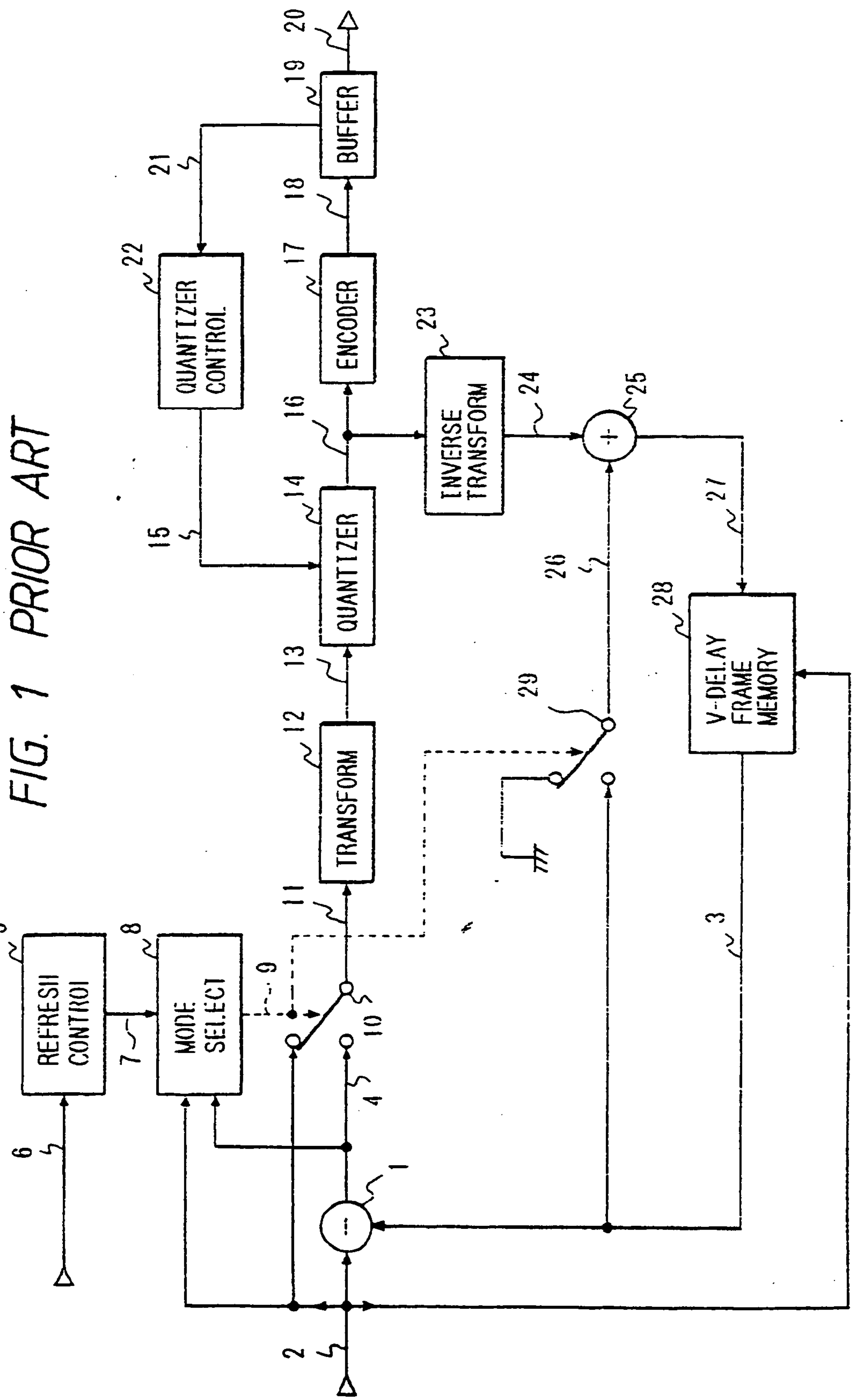


FIG. 1 PRIOR ART

FIG. 2 PRIOR ART

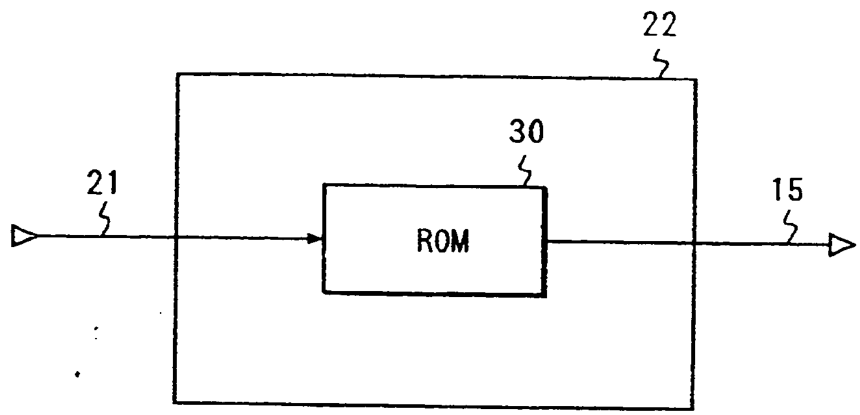
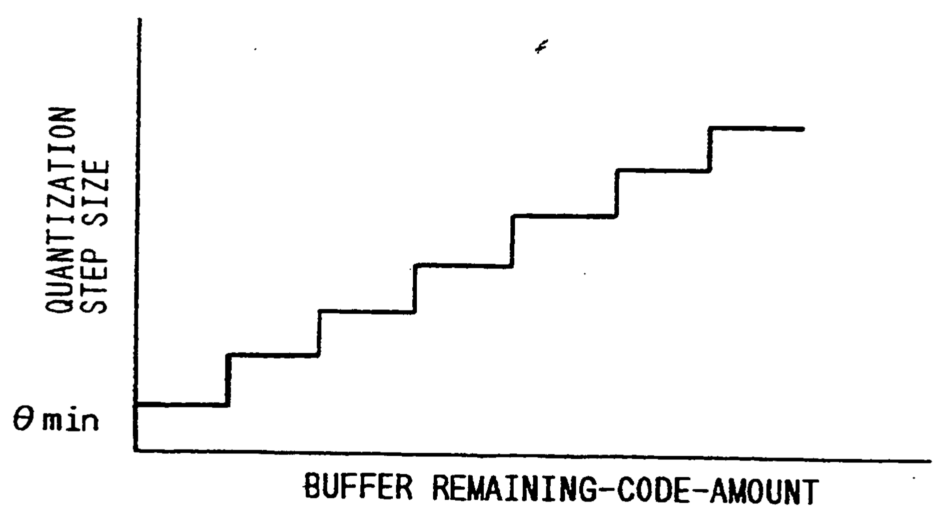
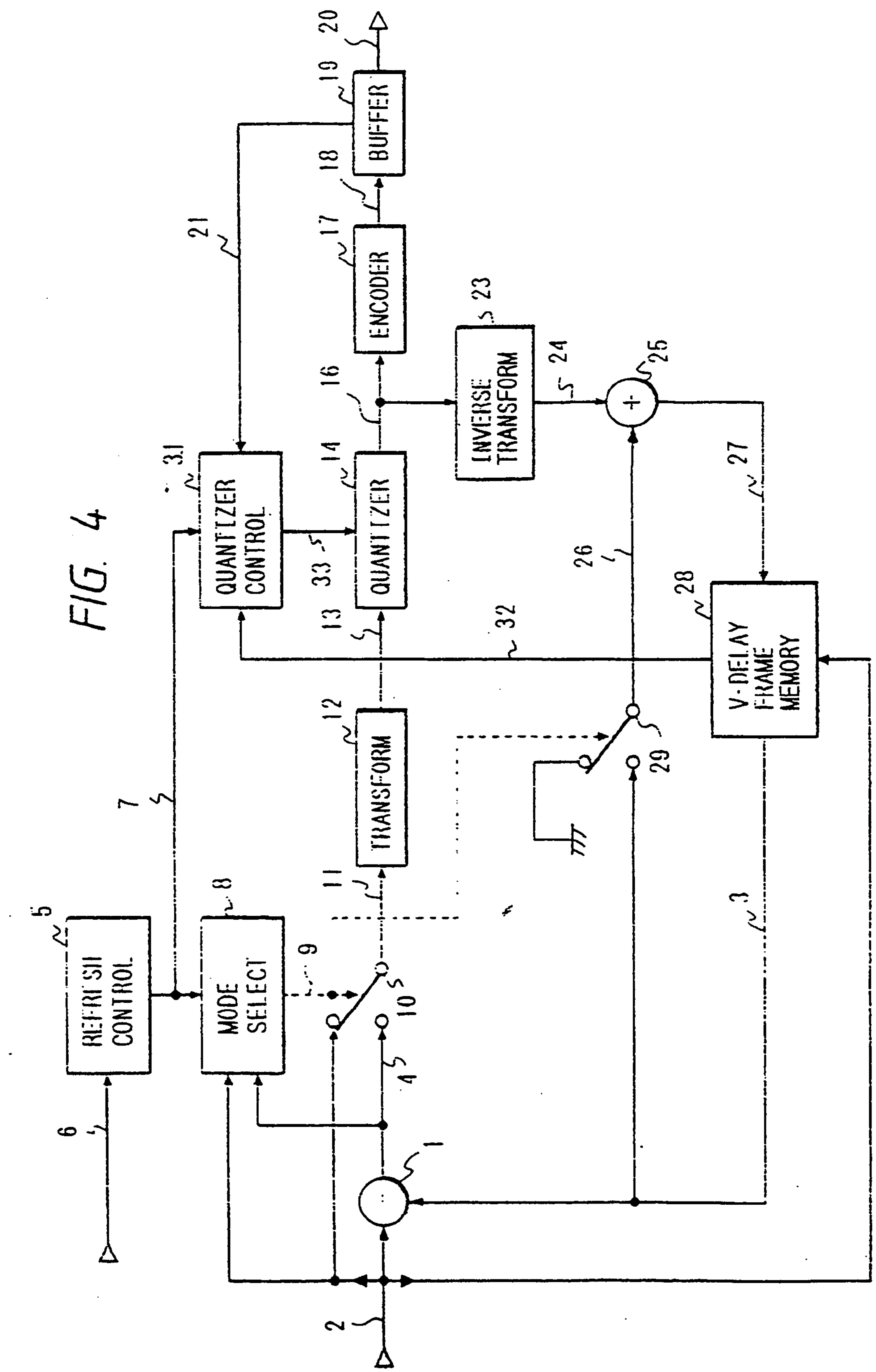


FIG. 3 PRIOR ART




REFRESH CONTROL
MODE SELECT
TRANSFORM
QUANTIZER CONTROL
QUANTIZER
ENCODER
BUFFER
INVERSE TRANSFORM
V-DELAY FRAME MEMORY
1
2
3
4
5
6
7
8
9
10
11
12
13
14
16
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21
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31
32
33

FIG. 4

FIG. 5

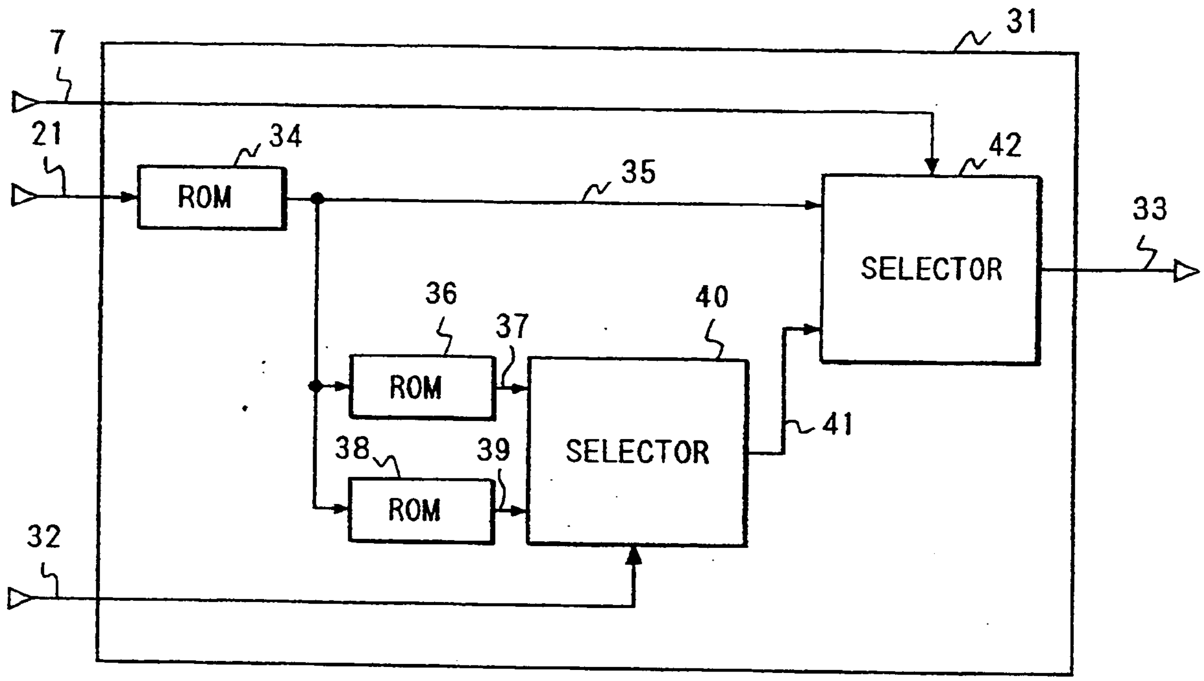

7
21
34
ROM
35
31
42
SELECTOR
33
36
37
ROM
40
SELECTOR
41
38
39
ROM
32

FIG. 9

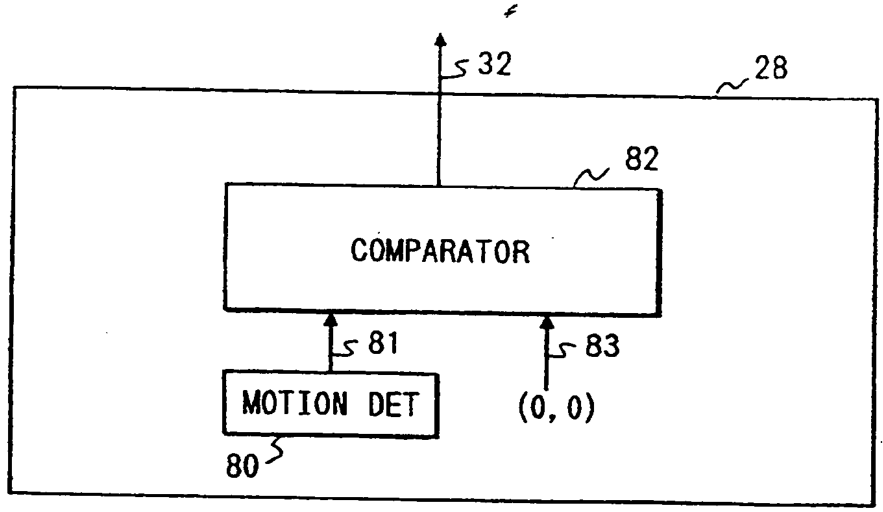

32
28
82
COMPARATOR
81
83
MOTION DET
(0, 0)
80

FIG. 6

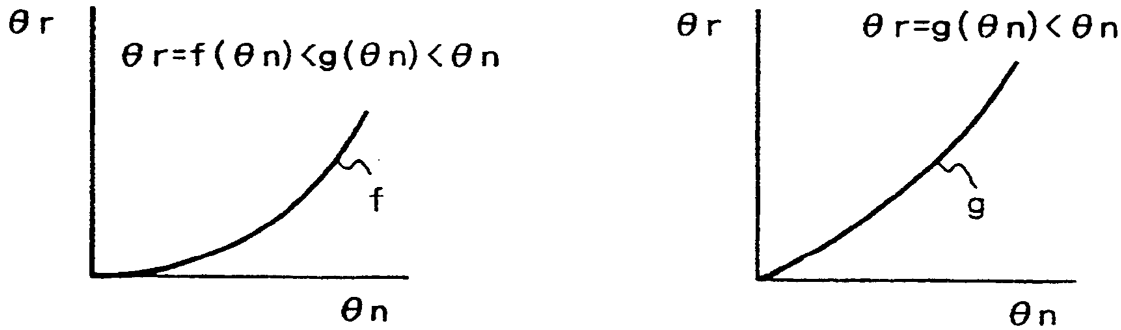


FIG. 7

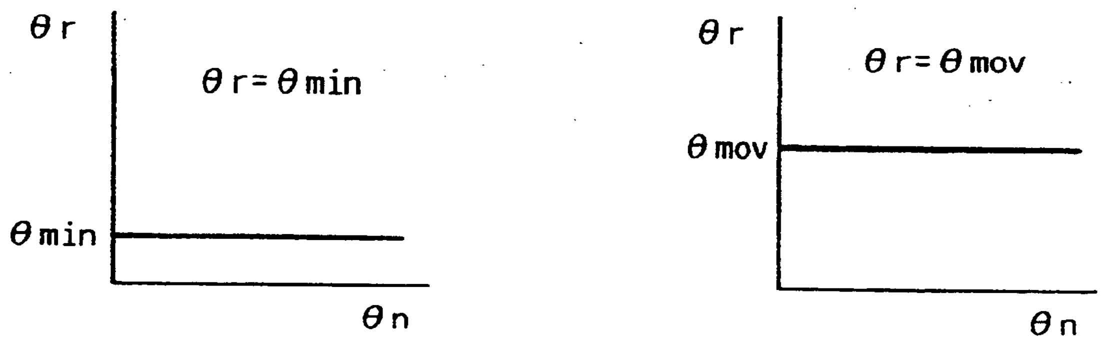
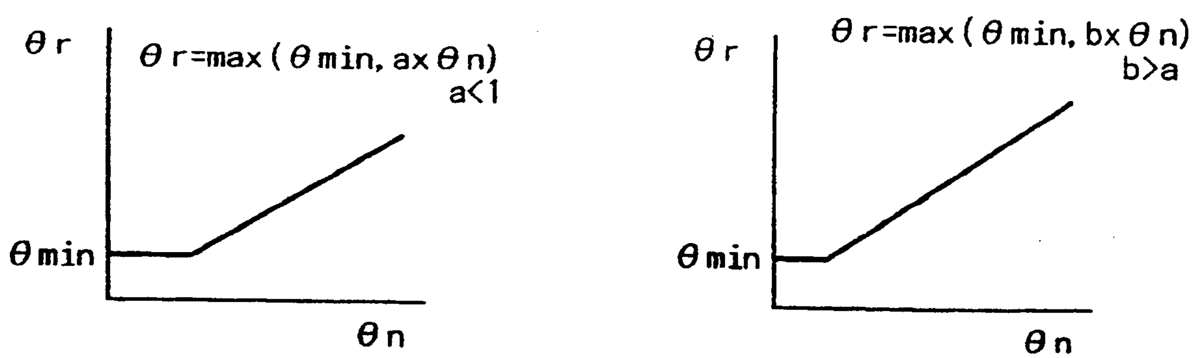


FIG. 8



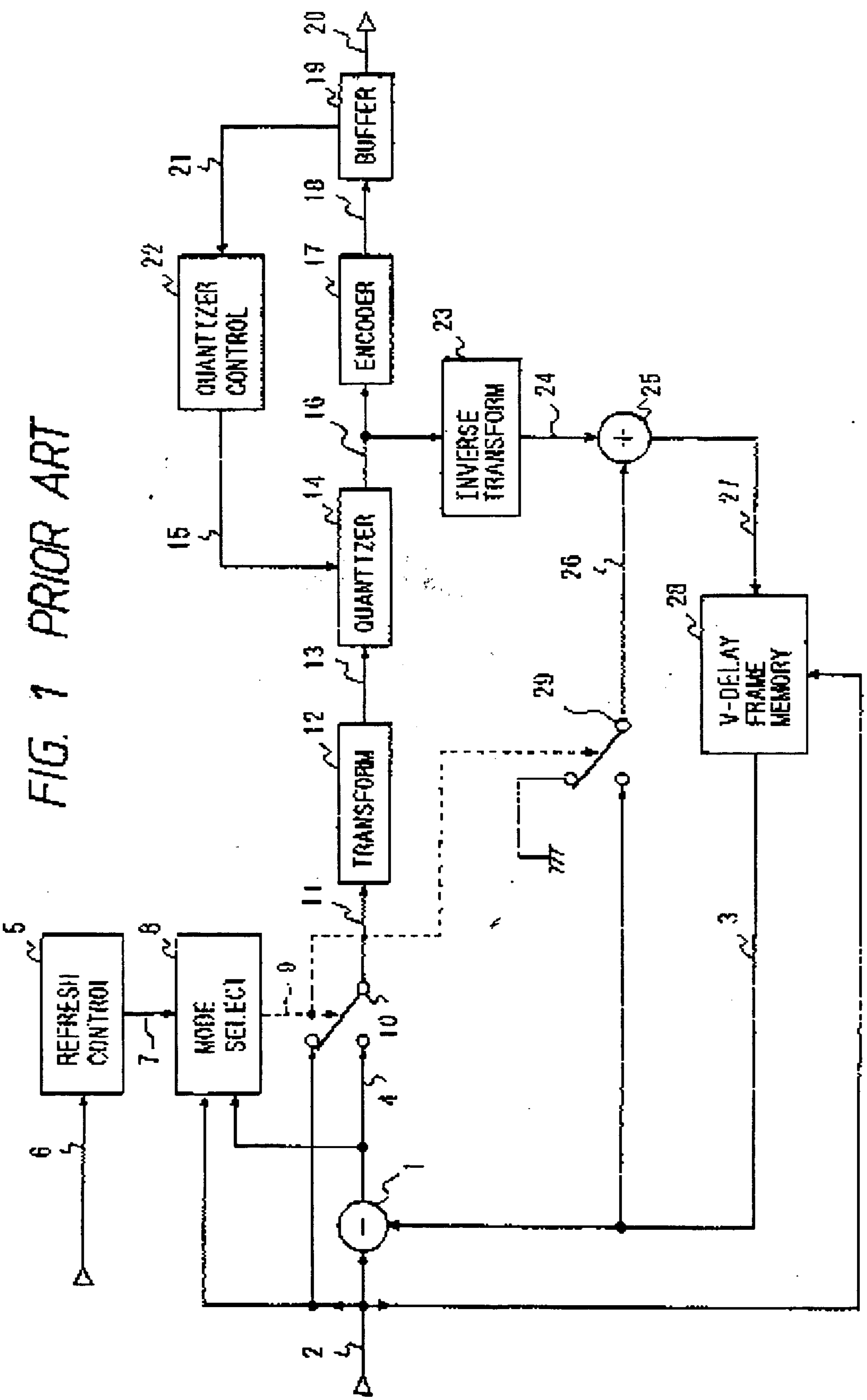


FIG. 1 PRIOR ART

FIG. 2 PRIOR ART

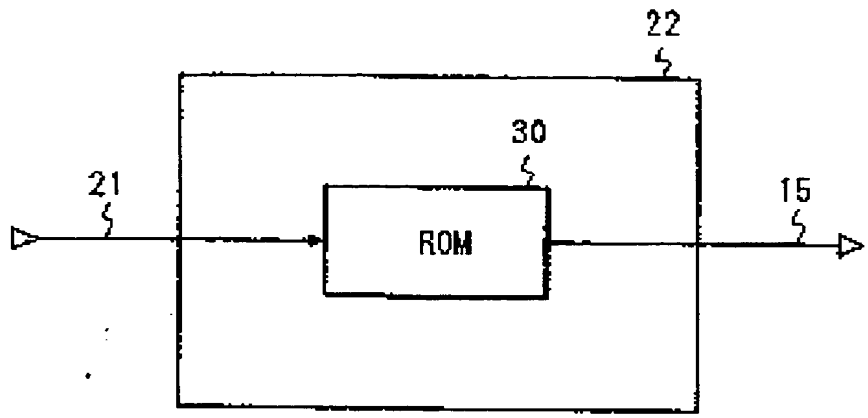
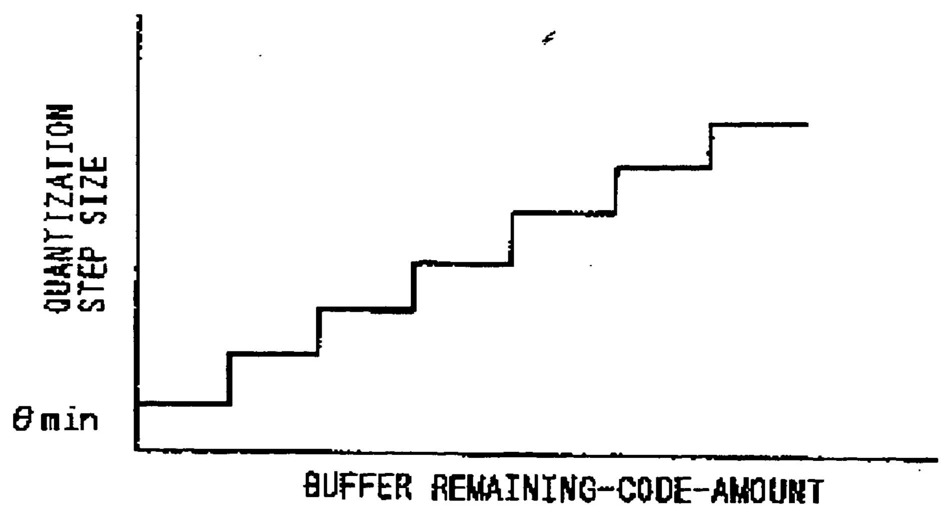


FIG. 3 PRIOR ART



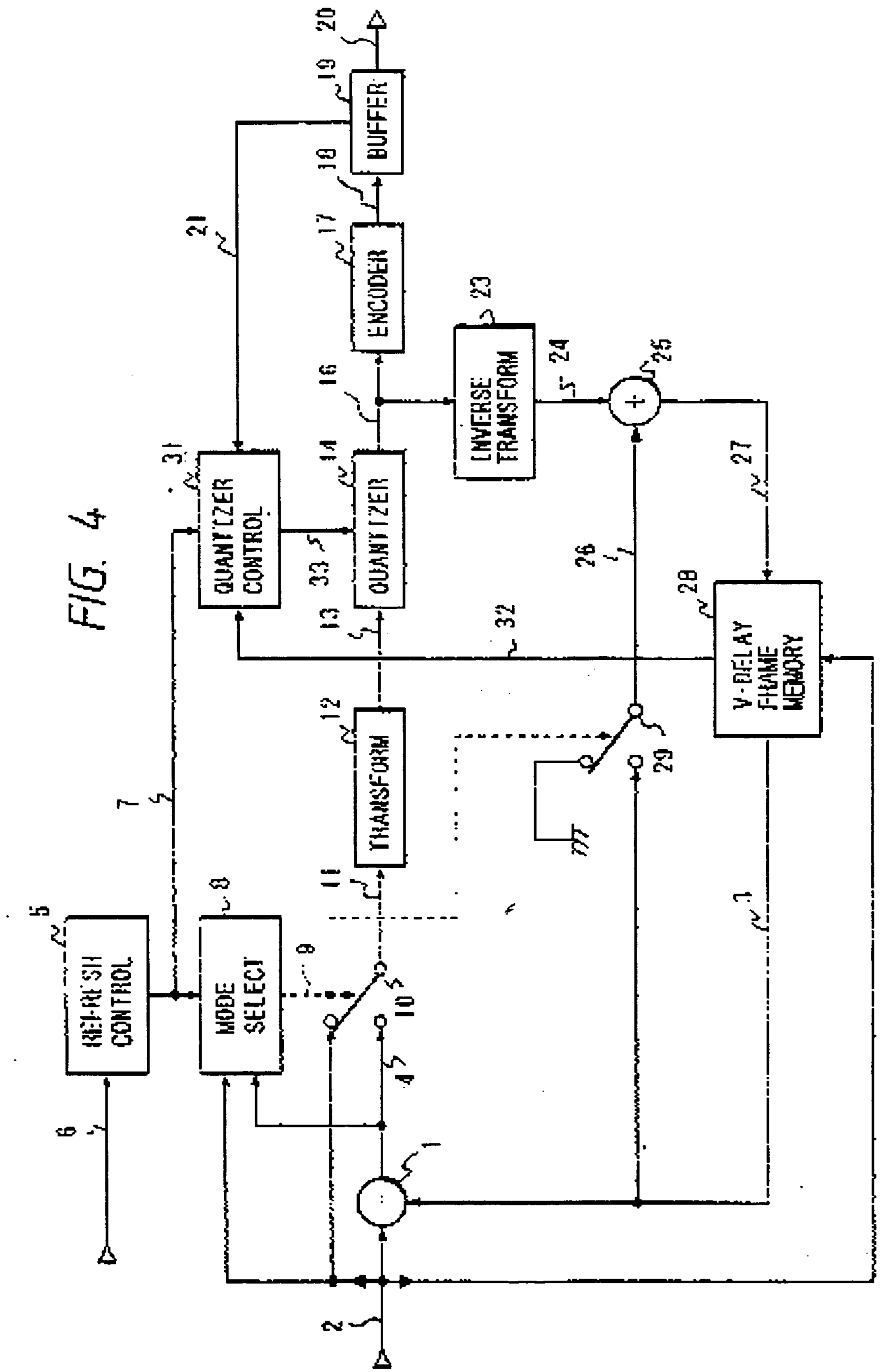

REFRESH CONTROL
MODE SELECT
TRANSFORM
QUANTIZER CONTROL
QUANTIZER
ENCODER
BUFFER
INVERSE TRANSFORM
V-DELAY FRAME MEMORY

FIG. 4

FIG. 5

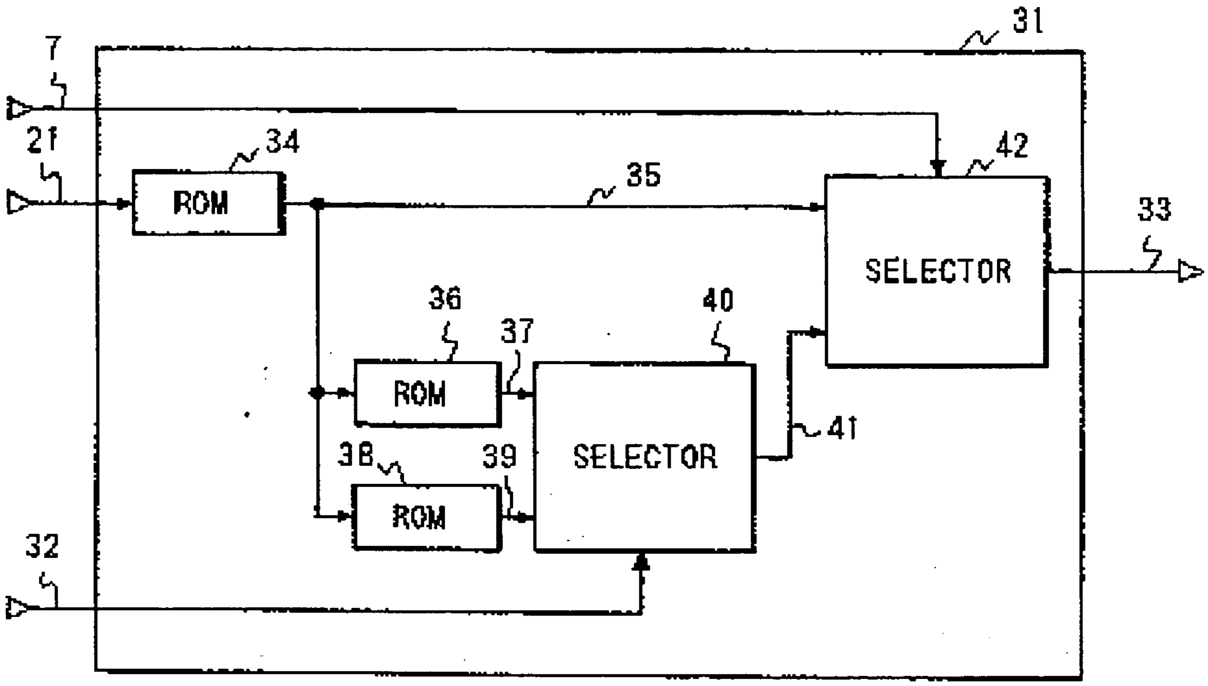

31
7
21
34
ROM
35
42
SELECTOR
33
36
37
40
ROM
SELECTOR
41
38
39
ROM
32

FIG. 9

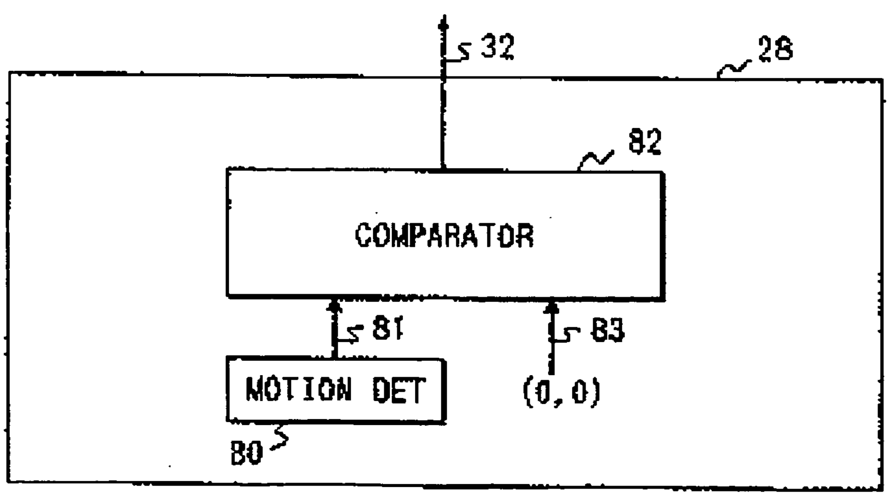

32
28
82
COMPARATOR
81
83
MOTION DET
(0, 0)
80

FIG. 6

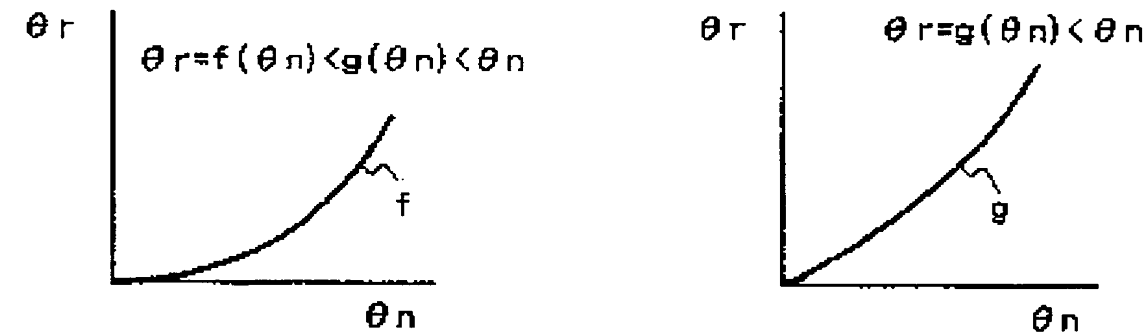


FIG. 7

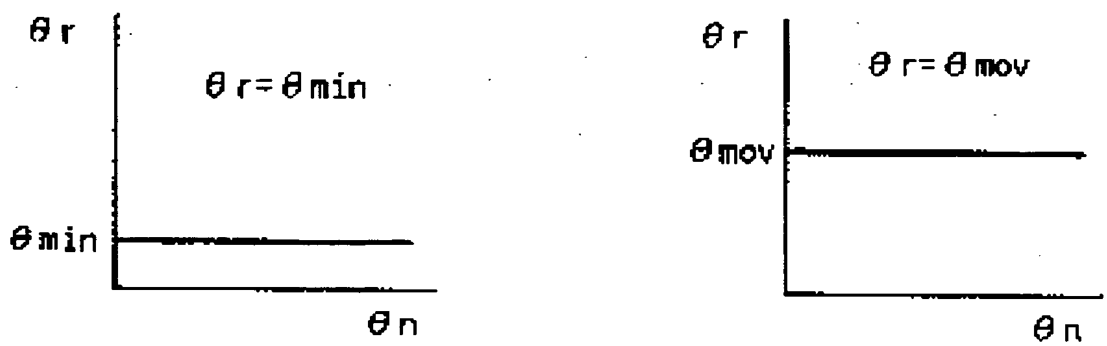


FIG. 8